

Smith River Bridge (Hiouchi Bridge)
Spanning Smith River on on Post Mile 4.22
of California State Highway 199
Crescent City vicinity
Del Norte County
California

HAER No. CA-75

HAER
CAL,
8-CRELIV,
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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
Western Regional Office
National Park Service
U. S. Department of the Interior
San Francisco, California 94102

HISTORIC AMERICAN ENGINEERING RECORD

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(Hiouchi Bridge)

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Location: Spanning Smith River at Post Mile 4.22 of California
State Highway 199
Crescent City vicinity, Del Norte County, California

UTM: 10.410120.4628700-10.410260.4628575
Quad: Hiouchi, California (7.5')

Date of Construction: 1928-29

Engineer: Engineering Staff
Bridge Department
California Division of Highways
Sacramento, California

Present Owner: California Department of Transportation
District 1
P.O. Box 3700
Eureka, California 95501

Present Use: Demolished, July 1989

Significance: The Smith River Bridge was a rare California example of
the cantilever highway truss bridge, a bridge type that
enjoyed brief popularity during the decade spanning the
late 1920s to the late 1930s. Because the type was
best suited to specialized applications, only limited
numbers were built in the State. Indeed, there are
only seven remaining, following removal of the Smith
River Bridge. The Smith River Bridge was the first
cantilever bridge design executed by State Highway
engineers, and likely was influenced by D. B.
Steinman's Carquinez Bridge (1923-27).

PART I. HISTORICAL INFORMATION

The building of the Smith River Bridge was an element of the relocation of the old Smith River Road (presently State Highway 197) in the development of the Redwood Highway, then under construction between Sausalito and the Oregon border. The plans for this roadway relocation and improvement were dated as early as 1926, though final bridge plans were not ready until 1928. Roadway improvements were being undertaken, using convict labor. Economy and local conditions dictated the choice of a cantilever design; the type required no expensive falsework be placed in the channel. The Smith River carried large drift and was apt to rise rapidly at any time of year, conditions which would have threatened falsework, any structure thus supported, and workers as well. On April 17, 1928, the State awarded the construction contract to the Parker-Schram Company. Contract approval followed on May 7, and construction began on May 21, 1928.

The initial stages of construction involved roadway excavation and site clearing, with the contractor's forces beginning work on the Oregon side of the river (actually at the southeast end of the bridge, as the road alignment is N/W-S/E at this point, and still well within California) on June 1, 1928. This involved removal of trees and brush, and blasting and bulldozing of boulders. After placing roadway material, initial smoothing was done by hand with picks and shovels, with final grading accomplished with a Russel grader pulled by a tractor. With work completed on that side of the river, the power shovel in use there cut a road for itself down to the riverbed and forded the river at a shallows just downstream from the bridge site. Similar preparation then began on the Crescent City side of the river on August 1, 1928.

Simultaneously, the work force had begun substructure excavation at Abutment 2 on June 7. Solid rock had to be drilled and shot with powder, and the hardness of the material made for slow progress. The footings were not poured until August 25, and the back wall on October 19, 1928. Piers 1 and 2 were excavated, cofferdammed, and pumped dry. Since pumps were able to keep the excavations dewatered, it proved possible to pour the piers "in the dry" rather than using tremie concrete, as called for by the plans. The contractor completed Pier 2 on September 20, and Pier 1 on October 8. Work on Abutment 1 was done entirely by hand, and was completed on October 16, 1928. Three days later, when Abutment 2 was finished, the job shut down with the concrete work complete and no structural steel yet on site.

The concrete work had involved materials from a variety of sources. Sand and aggregate came for the contractor's own plant in the bed of the river, while Pacific Portland Cement Company of Richmond furnished the cement. Square reinforcing steel came from the Pacific Coast Steel Company of South San Francisco. The Hobbs-Wall Lumber Company in Crescent City furnished form lumber, hauled 17 miles by truck over the old road to the bridge site; both redwood and Douglas fir shiplap were used. The other materials arrived by ship in Crescent City for transshipment to the site by truck.

The mixer was sited above Abutment 2, and the concrete was simply chuted into the forms and excavations for Abutment 2 and Pier 2. For Abutment 1 and Pier 1, the concrete was chuted to a hopper near Pier 2 and dumped into Stirling concrete buggies which were pushed by hand across the river on a floating log bridge to a point near Pier 1. From there, they were placed on a small car and hauled up an inclined track by a hoist powered by a Fordson tractor. At the top of the incline, they were pushed by hand to a chute system and the concrete was placed as at Abutment 2 and Pier 2.

The lack of structural steel kept the job shut down until January 8, 1929, when steel erection began on the Oregon side of the river. Steel for the superstructure came from the Virginia Bridge and Iron Works, Roanoke, Virginia, having been furnished to that firm by Carnegie Steel Company of Pittsburgh and by Bethlehem Steel Company, Bethlehem, Pennsylvania. The material was shipped by way of the Panama Canal to San Francisco, where it was reloaded to a smaller coastal vessel and shipped to Crescent City. Unloaded there, it was stored temporarily at the Hobbs-Wall Lumber Company's yard. From there, half was hauled by truck to the Oregon end of the bridge site, using the old road to cover the 17-mile distance. The other half was trucked to the Crescent City end of the site over the new road, a distance of eight miles. The steel was unloaded onto the ground and simply stored that way until needed. All of the handling during the long shipment had left a large number of pieces bent and twisted, and the contractor had to undertake cold straightening before these could be used.

The contractor built a small industrial railroad from the storage site to the bridge site. As each steel piece was needed, it was lifted by derrick onto a small car which was then pulled by donkey engine onto the bridge to a place as near as possible to the point of erecting. The same donkey engine then powered a stiff-leg derrick that hoisted the member into place, where it was drift-pinned and bolted until final riveting, which was accomplished as soon as possible after each piece was erected. As with the other operations, work began on the Oregon side of the river and proceeded out to the point of joining for the suspended span. Then the cantilever was dismantled and hauled 26 miles around to the Crescent City side of the river and the operation was repeated, beginning on February 21, 1929. One month later, closure was made on the suspended span, with less than 1/4-inch of jacking necessary for final alignment. Riveting, however, continued until April 8.

From April through June, work centered around painting and decking the bridge. With the steel carrying much rust and mill scale, the painting subcontractor first attempted cleaning by wire brush. This proved slow and costly, with only 10% of the steel cleaned between April 1 and April 30. At that time, sand-blasting was undertaken to clean the remainder. Undercoatings were paints #501 and #322 from the Detroit Graphite Company, with White Japan drier required for the latter. These were applied both by brush and by sprayer. The final spray coat was Detroit Graphite Company Silver-Cool Aluminum Paint #325. Painting was completed on July 6, 1929.

Work on the redwood timber subfloor began on April 17, with work on the floor beginning on May 15, 1929. The floor paving itself was comprised of 115,000 3- by 3- by 6-inch redwood blocks, laid on end. The Hobbs-Wall Lumber Company supplied the blocks from lumber cut two to five years previously. For paving use, specifications required ten annual rings per inch. Some 30,000 blocks were rejected and replaced under this specification. Workers prepared the subfloor by covering it with 3-ply felt and painting that surface with hot "Petrolastic Cement XX," an asphaltic material made by Standard Oil. They then placed the blocks by hand, stopping every fourth or fifth row to align the blocks with a wooden template. Having beaten more "Petrolastic Cement" in a large kettle, workers then poured the material between the blocks, using small coffeepots. The State's engineer noted this resulted in a good job for the State, "...but was very costly and inefficient method for the contractor." They then poured 1-1/2-inches of hot asphalt over the blocks, smoothed it with hot irons, and finally threw dry sand into the still-hot material. The floor was completed on June 21, 1929, and the bridge was officially opened the following day (though it was July 6 before all work was completed).

On June 22, 1929, Governors C. C. Young of California and I. L. Patterson of Oregon, highway officials from California, Oregon, and Washington, as well as more than one thousand others gathered at the bridge for a noontime dedication. As the autos of the two governors slowly broke the barrier of greenery and ribbons, the wife of the chairman of the California Highway Commission broke a bottle of water from the Smith River (this occurred during Prohibition) over the railing and christened the bridge "Hiouchi," reported an Indian word meaning blue water, a reference to the river. The completion of the bridge marked highway, and the speakers hailed the accomplishment, predicting world fame for the route, and a greater union between California and the rest of the Pacific Coast.

PART II. ARCHITECTURAL INFORMATION

The Smith River Bridge, also known as the Hiouchi Bridge or Bridge No. 1-06, located at Post Mile 4.22 in Del Norte County on California State Highway 199, is described As a through steel cantilever truss with suspended center span. The basic truss forms are derivatives of the Pratt truss, with vertical members in compression and diagonals in tension; the suspended center span is a Parker truss. The superstructure rests on a substructure comprised of reinforced concrete solid piers and seat abutments, all founded on spread footings. The bridge was 615 feet long overall, 25.6 feet wide, and carried a two-lane, 24-foot roadway between steel lattice railings, and crossed the Smith River at right angles (no skew). The Parker-Schram Company was contracted to complete the structure at a cost of \$154,987.47, the plans having been prepared in 1928 by the Bridge Department, California Division of Highways.

PART III. SOURCES OF INFORMATION

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- Panhorst, F., "Final Report of the Redecking of the Smith River Bridge," California Department of Transportation, Sacramento, California, October 24, 1940.
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PART IV. PROJECT INFORMATION

Studies for the replacement of the Smith River Bridge began in 1987. State Highway 199 provides a link between Highway 101 at Crescent City, on the northern California coast, and Interstate Highway 5 at Grants Pass, Oregon. The proposal to replace the bridge was based on its functionally obsolete structural condition. Because of the high percentage of heavy truck traffic utilizing this route, and the amount of damage the bridge had sustained over the years from high loads, there was concern that the bridge was susceptible to collapse under some damage conditions. Because of this, a warning system was installed in 1975 to identify and divert overheight loads to an alternate route around the bridge. This warning system, however, only protected the bridge from southbound traffic coming down from Oregon. In theory, California's permit system for the movement of large loads protected the bridge from such traffic originating in California.

By early 1989, the environmental process for the replacement of the bridge was largely complete. Section 106 studies had concluded that removal of the bridge, which had been determined eligible for inclusion in the National Register of Historic Places, constituted an adverse effect. A Memorandum of Agreement (MOA) among the Advisory Council on Historic Preservation (ACHP), the Federal Highway Administration (FHWA), and the California State Historic Preservation (SHP0) was executed in April 1989, and ratified by the ACHP on May 30, 1989. Among other things, the MOA stipulated that the bridge be recorded to HAER standards prior to its removal. However, other forces were at work.

At 5:20 a.m. on March 31, 1989, a truck crane, the height and weight of which exceeded legal limits and therefore constituted a "permit" load, and traveling north from Crescent city without having obtained the necessary permit, attempted to cross the Smith River Bridge. Apparently traveling at excessive speed which caused the crane to bounce, the driver managed to bounce the load onto the bridge without striking the portal. The crane then struck the cross frame at panel point 2, tearing it away, and the cross frame at panel point 6, directly over the "south" pier (pier 2), bending it. The point of impact was at the gusset plate some fifteen feet above the bridge deck, and the frame bent the lower member of the cross frame three feet in the direction of travel. This impact pulled inward the vertical members to which the cross frame was connected, buckling them and causing the failure of adjacent vertical members. This damage occurred directly within the "south" cantilever tower. At that point, the trusses were normally eight feet deeper than the cantilever arms and the suspended span. The impact deformed the tower, so that the upper chord was pulled into an almost horizontal line. After the impact, the driver of the truck managed to back his vehicle off the bridge. At this point, tragedy almost occurred.

A second truck, coming southbound from Oregon with a load of anhydrous ammonia, entered the bridge without realizing it had been damaged, and its trailers became wedged in the damage cross frame at pier 2. The end of the cantilever arm sagged at the point of connection with the suspended span, and the bridge became deflected and deformed some 47 inches vertically. The second truck was still wedged in place when a structural engineer from Caltrans arrived on site at 2:15 p.m. that same afternoon.

There was a great deal of concern because of the nature of the cargo, and the initial difficulty of discerning whether the truck was preventing the bridge from total collapse, or was merely wedged under the damaged cross frame. The engineer eventually determined that the latter was the case, and the trailers were removed by pulling them back across the bridge while the tractor was pulled ahead. Temporary steel shoring was placed under the buckled vertical members at pier 2, cables were wrapped around the damaged members, and a horizontal strut was bolted between the trusses above the buckled area of the

verticals. With total collapse thus prevented, the bridge was closed and traffic detoured by way of highways 101 and 197. Damage was estimated at \$1.5 million.

Because of this accident, project schedules were advanced to enable timely replacement of the bridge, since it would no longer be possible to proceed with the original plan of erecting the new bridge while leaving the old bridge in service during construction. Even as the process of ratification of the MOA was ongoing, HAER recordation was carried out on May 3, 1989. Demolition of the Smith River Bridge was carried out during the week of August 14-18, 1989.